**Sunoco Inc.**
100 Green Street
PO Box 426
Marcus Hook PA 19061

August 9, 2012

Division of Air Quality
DEP Southeast Regional Office
2 East Main Street
Norristown, PA 19401-4915

City of Philadelphia
Air Management Services
321 University Avenue, 2nd Floor
Philadelphia, PA 19104

Re: Sunoco Inc. R & M Marcus Hook Refinery
Refinery Sources Permanent Shutdown and Emission Reduction Credit Application

Dear Sirs:

Pursuant to the August 7, 2012 Order issued by Philadelphia Air Management Services, and the August 7,, 2012 administrative permit amendment issued by the Pennsylvania Department of Environmental Protection, Sunoco Inc. R & M (Sunoco) operates the Philadelphia Refinery in Philadelphia County, Philadelphia, and the Marcus Hook refinery located at Marcus Hook, Delaware County, Pennsylvania under Title V Operating Permit (TVOP) No. V95-038 and TVOP No. PA23-00001 respectively. The air contaminant sources in these two facilities are considered a single source for New Source Review, Prevention of Significant Deterioration and Title V applicability purposes.

Sunoco permanently shutdown in December 2011 the refinery sources specified below that are located in Marcus Hook and is hereby requesting that the sources be removed from TVOP No 23-00001. A Title V Operating Permit Administrative Amendment form is included as Attachment 1. Sunoco is also submitting this Emission Reduction Credit Registry (ERC) Application to the Pennsylvania Department of Environmental Protection (PADEP) and the City of Philadelphia Air Management System (AMS). Attachment 2 provides the completed ERC Application Form. Sections 3 through 8 of the application are included in Attachment 2. The refinery sources that were shutdown include the following sources:

Consent Decree Paragraph 99A sources:

1. Source ID: 040 10-4 Feed Heater;
2. Source ID: 101 PLT. 10-4 FCC Unit (includes carbon monoxide boilers COB1 and COB3);
3. Source ID: 705 12-4, H-01 LSG Heater; and
4. Source ID: 706 12-4, H--02 LSG Stabilizer Heater.

Consent Decree Paragraph 100 sources:

1. Source ID: 045 12-3 Desulf. Heater;

2. Source ID: 060 15-1 Crude Heater;
3. Source ID: 075A 17-2A, Heaters (H01, H02, H03);
4. Source ID: 078 17-2A, H-04 Heater;
5. Source ID: 099 12-3 Crude HTR.H3006. and
6. Source ID: 111 Cooling Towers

Be aware that only the following cooling towers are included in this application: 10 Plant A and B, 12 Plant North and South, 17-1A, 17-2, 17-2A and the LSG cooling tower. All other cooling towers listed in TVOP PA23-00001 under ID 111 are not part of the application and their operating permit will continue to be in effect.

The ERC application seeks to register reductions from the shutdown of the above units to be used for netting or as offsets at the Philadelphia Refinery pursuant to the paragraphs of the Fourth Amendment to the Consent Decree, No. 05-02866 (E.D.Pa.), referenced above under TVOP No. V95-038 for nitrogen oxide ($NO_x$), sulfur dioxide ($SO_2$), volatile organic compounds (VOC), carbon monoxide (CO), particulate matter less than 10 microns ($PM_{10}$), particulate matter less than 2.5 microns ($PM_{2.5}$), greenhouse gases (GHG) reported as $CO_2e$, and as $CO_2$, $CH_4$ and $N_2O$, and sulfuric acid mist (shown as sulfur trioxide ($SO_3$)).

The amount of ERCs requested in the application are based on the emissions reported in PADEP's Air Information Management System, except for $SO_3$, which is reported as part of the Toxics Release Inventory Program, and GHG, which are the emissions reported to the EPA as required by the Mandatory Reporting of Greenhouse Gases rule under 40 CFR Part 98. The GHG emissions were calculated using EPA's approved methodologies as documented in the written GHG Monitoring plan required in 40 CFR 98.3(g)(5). Copy of the plan is included in Attachment 3.

If you have any questions or comments regarding this letter, please contact me at 610-859-1695.

Sincerely,

Terry Soulé

Director, Environmental Services & Policy

\Enclosures

Attachment 1 – Title V Operating Administrative Amendment Form and Permit Fee
Attachment 2 - ERC Application Form
Attachment 3 – Section 2-8 of the Application
Attachment 4 – GHG Monitoring Plan

cc: Arnold D Dodderer
Charles D. Barksdale
Douglas G. White
Patrick K. O' Neill
George C. Hopkins

Sun Federal

1735 Market Street, Suite C-16
Philadelphia, PA 19103
(215) 751-1610

Void if not cashed within three (3) months of issue date. Two signatures required on checks greater than $50,000.

**No. 236672**

56-8241 / 2412

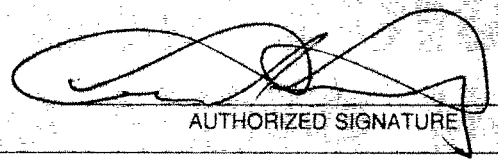
07/26/2012

PAY

Seven Hundred Fifty Dollars and 00 cents $750.00

TO THE ORDER OF

Commonwealth of PA
Clean Air Fund
Marcus Hook Permit



AUTHORIZED SIGNATURE

⑈236672⑈ ⑆241282412⑆000000555555 2⑈

2700-PM-AQ0020 1/2003

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR QUALITY

# Request for State Only/Title V Operating Permit Administrative Amendment (in accordance with 25 Pa. Code § 127.450)

| | | | |
|---|---|---|---|
| 1. | **Applicant's Name:** Sunoco Inc R&M<br>**Facility Name:** Marcus Hook Refinery | **Federal Tax ID:** | 23-1743283-12 |
| | **Street Address or Route Number of Source:** 100 Green Street, Marcus Hook, PA 19061 | | |
| | **Township/Municipality:** Marcus Hook Borough | **County:** | Delaware |

**2. Mark appropriate box(es) regarding the basis for this request.**

- ☐ Corrects typographical errors
- ☐ Identifies a change in the name, address or phone number of the Responsible Official identified in the permit or provides a similar change
- ☐ Requires more frequent monitoring or reporting by the permittee
- ☒ Allows for a change in ownership or an operational control of a source in accordance with § 127.450(a)(4) (*Complete the Change of Ownership Form and a Compliance Review Form*)
- ☐ Incorporates plan approval requirements into an operating permit in accordance with § 127.450(a)(5)

**3. Operating Permit/Plan Approval No(s):** Title V Permit No. 23-00001

**4. Describe in detail the reasons for submission of this request. Attach additional sheet(s) if necessary.**

This Administrative Amendment application seeks to remove from the Sunoco Inc Marcus Hook refinery TVOP No. 23-00001 the following operating sources that were permanently shutdown in December 2011: Id. 040, 10-4 Feed Heater; Id. 045, 12-3 Desuif. Heater; Id. 060, 15-1 Crude Heater; Id. 075, 17-2A Heaters (H-01, H-02, H-03); Id. 078, 17-2A H-04 Heater; Id. 099, 12-3 Crude Heater H-3006; Id. 101, 10-4 FCC unit including COB1 and COB3; Id. 705, 12-4 H-01 LSG Heater; Id. 706, 12-4 H-02 LSG Heater; and the following cooling towers from Id. 111: 10 Plant A&B, 12 Plant North & South, 17-1A, 17-2, 17-2A and the LSG cooling tower. The operating permits for all other cooling towers in Id. 111 will remain in effect.

The application seeks also to remove the cap language from the operating permit terms and conditions of the four auxiliary boilers(Id. 031, 032, 033 and 034) as a rusult of the Id. 101, FCC unit, shutdown. It is Sunoco's understanding that an Aministrative Amendment will be submitted by NextEra Energy to remove from their Title V permit the cap language from the sources included in the cap.

| | | | |
|---|---|---|---|
| 5. | **Contact Person Name:** Terry Soule | **Title:** | Director, Environmental Services and Policy |
| | **Mailing Address:** PO Box 426,<br>Marcus Hook, PA 19061-0426 | **Telephone Number:** | 610-859-1695 |
| | | **Fax Number:** | 610-859-3311 |

## Certification by Responsible Official

**Subject to the penalties of Title 18 Pa. C.S. Section 4904 and 35 P.S. Section 4009 (b) (2), I certify under penalty of law that, based on information and belief formed after reasonable inquiry, the statements and information contained in this form are true, accurate, and complete.**

| | | | |
|---|---|---|---|
| **Name:** | John D Pickering, | **Title:** | SVP Manufacturing |
| **Signed:** | John D Pickering | **Date:** | 8/14/2012 |

ERCAPP.DOC: Rev. 6/99

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR QUALITY

# Emission Reduction Credit (ERC) Registry Application

- *This ERC Registry Application may be used by a major or non-major facility.*
- *ERCs may be created only if the ERC Registry Application is filed within one year of actual emission reductions.*
- *Read instructions for the ERC Registry Application prior to completing this form.*

## Section 1 - Identity and Location of Air Contamination Source

### 1A. Facility/Corporation Information

| | |
|---|---|
| Facility Name:<br>Sunoco Marcus Hook Refinery | Facility Address:<br>100 Green Street, Marcus Hook, PA 19061 |
| Telephone Number: 610-859-1695 | Fax Number: 610-859-3311 |

### 1B. Facility Operator Information

(Complete if operator is different from company)

| | |
|---|---|
| Operator's Name: Sunoco Inc. R & M<br>Federal ID Number: 23-1743283 | Company Address:<br>1818 Market Street, Suite 1500, Philadelphia, PA 19103 |
| Telephone Number: 215-977-3000 | Fax Number: 866-302-2146 |

### 1C. Plant/Facility Information

| | |
|---|---|
| Plant Name: Sunoco Marcus Hook Refinery<br>Federal ID Number: 23-1743283/12 | Plant Address: 100 Green Street, Marcus Hook, PA 19061 |
| Telephone Number: 610-859-1695 | Fax Number: 610-859-3311 |
| Municipality/Township: Marcus Hook | County: Delaware |

### 1D. Facility Type

| | |
|---|---|
| ☒ Major Facility ☐ Non-Major Facility | Permit No. (Title V/RACT/Synthetic Minor): 23-00001 |

### 1E. Contact Person for this Application

| | |
|---|---|
| Name: Terry Soule<br>Title: Director, Environmental Services & Policy | Mailing Address:<br>100 Green Street, Marcus Hook, PA 19061 |
| Telephone Number: 610-859-1695 | Fax Number: 610-859-3311 |

### 1F. Certification Statement

I, John Pickering, certify under penalty of law as provided in 18 Pa. C.S.A. § 4904 and 35 P.S. § 4009(b)(2)) that I am authorized to make this Certification on behalf of the facility identified in this application and based on information and belief formed after reasonable inquiry, the statements and information in this application are true, accurateand complete. I further certify that the emission reductions will be maintained as set forth in this application and that the emission reductions were not previously used in netting transactions, alternative emissions limitations, acid rain allowances or to generate other emission reduction credits.

Signature SVP Manufacturing Title Date 8/8/2012

## Section 2 - ERC-Generating Source Information

Provide the following information for the ERC-generating source

| | |
|---|---|
| 2A. Type of Source: See Attached ERC Generating Source Table for information on each source. | 2B. Plan Approval\Permit Number: _____<br>Note: A permit is required for any source that is continuing to operate |
| 2C. Manufacturer of Source: | 2D. Model Number: |
| 2E. Date of Installation of the Source: | 2F. Air Cleaning Device |
| 2G. Source ID/Designation | 2H. Hourly Rated Capacity |
| 2I. Annual Throughput: | 2J. Other Information: |

## Section 3 - ERC Generation Techniques

Check appropriate box(es) to identify applicable ERC-generating technique(s)

- ☒ Shutdown of a source at an existing facility
- ☐ Shutdown of an existing facility
- ☐ Permanent curtailment of production or operation hours
- ☐ Improved control measures including improved control of fugitive emissions
- ☐ Installation of an air pollution control devise beyond regulatory requirements
- ☐ Use of lower volatile organic compound (VOC) coatings than required
- ☐ New technology and/or materials (not required by applicable law)
- ☐ Process equipment modifications (not required by applicable law)
- ☐ Incidental emissions reduction of nonhazardous air pollutants
- ☐ Economic Incentive Program
- ☐ Other: _____

## Section 4 - Intended use of ERCs

Check appropriate box(es) to specify intended use of ERCs

- ☒ Netting/Offsetting
- X Banking/Trading/Selling Purposes

## Section 5 –Emissions Reduction Initiation Date

Actual/Expected Date of Initiation of Emission Reduction: July 27, 2012

## Section 6 - Baseline Emission Rate Summary

Baseline emission rate (expressed in lbs/hr or tons/yr) is based on the lower of actual or allowable emissions calculated over two (2) calendar years immediately preceding the reduction unless otherwise approved by the Department.

| Calendar Year | Hours of Operation | VOC lbs/hr | VOC TPY | NOx lbs/hr | NOx TPY | Other _____ lbs/hr | Other _____ TPY |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| Average: | | | | | | | |
| Average Actual Emissions corrected with applicable SIP limitations * *RACT/MACT/LAER/BACT, etc. | | | | | | | |
| Revised Allowable Emissions after emission reductions: | | | | | | | |
| Available ERCs: | | | | | | | |

See Attached Baseline Emission Rate Summary Table for each ERC source.

Emission rates after reduction:

VOC: _____ Lbs/Hour _____ Tons/Year
NOx: _____ Lbs/Hour _____ Tons/Year
Other: _____ Lbs/Hour _____ Tons/Year

Do the above baseline emission estimates agree with emission statements submitted for PEDS/AIMS and any fees that have been paid, if applicable?

☒ Yes ☐ No If "No", submit request to amend emissions inventory along with this application.

Is the facility subject to any proposed maximum achievable control technology standards for hazardous air pollutants (MACT)? If yes, specify federal citation including Subpart.

☒ Yes Subpart: 40 CFR 63 F, G, H, Q and CC_____ ☐ No

## Section 7 - Emission Quantification Methods

Check appropriate box(es) for method(s) used to determine the baseline emission rate. Attach copies of source tests, summaries of records, measurements or calculation methods used to estimate the baseline emissions.

☒ Performance test data on same unit
☐ Performance test data on similar unit
☒ Continuous emission monitoring data
☐ Equipment vendor emission data and guarantees
☐ Emission factors from technical reference or article
☒ AP-42 Emission Factors Table Number: 1.4-1 and 1.4-2
☐ EPA Test Data Document Document Number: _____
☒ Other: Company Material Balance_____

## Section 8 - Emission Characteristics

Provide the following information to determine the ambient impact of the emissions reduction

| | |
|---|---|
| (a) Hours of Operation: See attached Emission Characteristics Table | (b) Hourly Rate (specify unit): |
| (c) Stack Height (from ground level): | (d) Stack Inside Diameter: |
| (e) Exhaust Volume: | (f) Exhaust Temperature: |

(g) Seasonal Period (months) Operated: _____ to _____

Is the affected source in compliance with all applicable requirements?

☒ Yes ☐ No If "No", attach a list of the violation(s), date(s) and location(s) specified in the Notice of Violation.

List all attachments provided to evaluate this ERC Registry Application.

Cover Letter

ERC Generating Source Table

Baseline Emission Rate Summary Table

Emission Characteristics Table

**OFFICIAL USE ONLY**

Regional Office: _____ Date Received: _____
Reviewed By: _____ Date Reviewed: _____
Plan Approval Number: _____ Date Submitted: _____
Previous Netting Transaction Date and Plan Approval Number: _____ _____
Comments:

Central Office NSR Section:
Reviewed By: _____ Entry Date: _____
Comments:

Sunoco Marcus Hook Refinery
ERC Registry Application
Section 2 - ERC-Generating Source Information
Attachment 2

| Source | 2A | 2B | 2C | 2D | 2E | 2F | 2G | 2H | 2I | 2J |
|---|---|---|---|---|---|---|---|---|---|---|
| | Type of Source | Permit Number | Manufacturer of Source | Model Number | Date of installation | Air Cleaning Device | Source ID | Hourly Rated Capacity | Annual Throughput | Other Information |
| 15-1 CRUDE HTR | Refinery fuel gas fired heater | Pa23-00001 | N/A | N/A | 12/1/1983 | None | 060 | 249 MMBtu/hr | 2,164,689.75 MCF | |
| 17-2A H-01, H-02, H-03 HTR | Refinery fuel gas fired heater | Pa23-00001 | N/A | N/A | | None | 075A | 213 MMBtu/hr | 1,145,156.63 MCF | |
| 17-2A H-04 HTR | Refinery fuel gas fired heater | Pa23-00001 | N/A | N/A | | None | 078 | 40 MMBtu/hr | 155,075.15 MCF | |
| 12-3 CRUDE HTR H-3006 | Refinery fuel gas fired heater | Pa23-00001 | N/A | N/A | 1/1/1988 | None | 099 | 249 MMBtu/hr | 1,745,656.50 MCF | |
| 12-3 DESULF HTR | Refinery fuel gas fired heater | Pa23-00001 | N/A | N/A | 1/1/1965 | None | 045 | 34 MMBtu/hr | 84,160.52 MCF | |
| 10-4 FCC UNIT* | Fluid Catalytic Cracking Unit | Pa23-00001 | N/A | N/A | 12/1/1963 | Two Carbon Monoxide Boilers and two Electrostatic Precipitators | 101 | 4,792 Bbl/hr | 32,738.72 MBbl | |
| 10-4 FEED HTR | Refinery fuel gas fired heater | Pa23-00001 | N/A | N/A | 1/1/1963 | None | 040 | 120 MMBtu/hr | 321,892.62 MCF | |
| LSG HDS HTR | Refinery fuel gas fired heater | Pa23-00001 | N/A | N/A | 2005 | LNB | 705 | 97 MMBtu/hr | 201,293.95 MCF | |
| LSG STABILIZR HTR | Refinery fuel gas fired heater | Pa23-00001 | N/A | N/A | 2005 | LNB | 706 | 53 MMBtu/hr | 206,046.56 MCF | |
| Cooling Towers | Cooling tower | Pa23-00001 | N/A | N/A | | None | 111 | N/A | N/A | |

All the emission sources included in this application were shutdown in December 2011.

Sunoco Marcus Hook Refinery
ERC Registry Application
Section 6 - Baseline Emission Rate Summary
Attachment 2

Rev on 08/08/12

| Source | Two-year Period | Hours of Operation | Hours of Operation | Hours of Operation | Pollutant | Emissions Year 2007 | | Emissions Year 2008 | | Emissions Average | | Average Actual Emissions | Revised Allowable | Revised Emissions | | Allowable ERCs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | lbs/hr | TPY | lbs/hr | TPY | lbs/hr | TPY | | | lbs/hr | TPY | |
| Id. 060 15-1 CRUDE HTR | 01/07 thru 12/08 | 8232 | 8760 | 8496 | NOx | 34.79 | 143.20 | 29.61 | 129.71 | 32.20 | 136.46 | Not applicable | Not applicable | 32.20 | 136.46 | 136.46 |
| | | | | | SO2 | 0.04 | 0.16 | 0.03 | 0.14 | 0.04 | 0.15 | Not applicable | Not applicable | 0.04 | 0.15 | 0.15 |
| | | | | | VOC | 1.29 | 5.30 | 1.10 | 4.80 | 1.19 | 5.05 | Not applicable | Not applicable | 1.19 | 5.05 | 5.05 |
| | | | | | CO | 19.73 | 81.19 | 16.73 | 73.28 | 18.23 | 77.24 | Not applicable | Not applicable | 18.23 | 77.24 | 77.24 |
| | | | | | PM10 | 1.69 | 7.40 | 1.51 | 6.63 | 1.60 | 7.02 | Not applicable | Not applicable | 1.60 | 7.02 | 7.02 |
| | | | | | PM2.5 | 1.69 | 7.40 | 1.51 | 6.63 | 1.60 | 7.02 | Not applicable | Not applicable | 1.60 | 7.02 | 7.02 |
| Id. 075 17-2A H-01, H-02, H-03 HTR | 01/07 thru 12/08 | 8640 | 8520 | 8580 | NOx | 13.81 | 60.50 | 12.23 | 53.57 | 13.02 | 57.04 | Not applicable | Not applicable | 13.02 | 57.04 | 57.04 |
| | | | | | SO2 | 0.01 | 0.05 | 0.01 | 0.06 | 0.01 | 0.05 | Not applicable | Not applicable | 0.01 | 0.05 | 0.05 |
| | | | | | VOC | 0.66 | 2.90 | 0.58 | 2.53 | 0.62 | 2.72 | Not applicable | Not applicable | 0.62 | 2.72 | 2.72 |
| | | | | | CO | 9.97 | 43.67 | 8.84 | 38.70 | 9.40 | 41.19 | Not applicable | Not applicable | 9.40 | 41.19 | 41.19 |
| | | | | | PM10 | 0.91 | 4.00 | 0.80 | 3.50 | 0.86 | 3.75 | Not applicable | Not applicable | 0.86 | 3.75 | 3.75 |
| | | | | | PM2.5 | 0.91 | 4.00 | 0.80 | 3.50 | 0.86 | 3.75 | Not applicable | Not applicable | 0.86 | 3.75 | 3.75 |
| Id. 078 17-2A H-04 HTR | 01/07 thru 12/08 | 8280 | 8664 | 8472 | NOx | 1.64 | 7.20 | 1.19 | 5.22 | 1.42 | 6.21 | Not applicable | Not applicable | 1.42 | 6.21 | 6.21 |
| | | | | | SO2 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 | Not applicable | Not applicable | 0.00 | 0.01 | 0.01 |
| | | | | | VOC | 0.09 | 0.40 | 0.07 | 0.29 | 0.08 | 0.35 | Not applicable | Not applicable | 0.08 | 0.35 | 0.35 |
| | | | | | CO | 1.39 | 6.10 | 1.00 | 4.39 | 1.20 | 5.25 | Not applicable | Not applicable | 1.20 | 5.25 | 5.25 |
| | | | | | PM10 | 0.14 | 0.60 | 0.09 | 0.40 | 0.11 | 0.50 | Not applicable | Not applicable | 0.11 | 0.50 | 0.50 |
| | | | | | PM2.5 | 0.14 | 0.60 | 0.09 | 0.40 | 0.11 | 0.50 | Not applicable | Not applicable | 0.11 | 0.50 | 0.50 |
| Id. 99 12-3 CRUDE HTR H-3006 | 01/07 thru 12/08 | 8448 | 8520 | 8484 | NOx | 21.99 | 96.30 | 18.87 | 82.66 | 20.43 | 89.48 | Not applicable | Not applicable | 20.43 | 89.48 | 89.48 |
| | | | | | SO2 | 0.03 | 0.13 | 0.03 | 0.13 | 0.03 | 0.13 | Not applicable | Not applicable | 0.03 | 0.13 | 0.13 |
| | | | | | VOC | 1.13 | 4.93 | 0.98 | 4.28 | 1.05 | 4.61 | Not applicable | Not applicable | 1.05 | 4.61 | 4.61 |
| | | | | | CO | 17.21 | 75.40 | 14.92 | 65.33 | 16.07 | 70.37 | Not applicable | Not applicable | 16.07 | 70.37 | 70.37 |
| | | | | | PM10 | 1.55 | 6.80 | 1.35 | 5.91 | 1.45 | 6.36 | Not applicable | Not applicable | 1.45 | 6.36 | 6.36 |
| | | | | | PM2.5 | 1.55 | 6.80 | 1.35 | 5.91 | 1.45 | 6.36 | Not applicable | Not applicable | 1.45 | 6.36 | 6.36 |
| Id. 045 12-3 DESULF HTR | 01/07 thru 12/08 | 7656 | 7032 | 7344 | NOx | 1.71 | 7.50 | 1.05 | 4.61 | 1.38 | 6.06 | Not applicable | Not applicable | 1.38 | 6.06 | 6.06 |
| | | | | | SO2 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 | Not applicable | Not applicable | 0.00 | 0.01 | 0.01 |
| | | | | | VOC | 0.09 | 0.40 | 0.06 | 0.25 | 0.07 | 0.33 | Not applicable | Not applicable | 0.07 | 0.33 | 0.33 |
| | | | | | CO | 1.44 | 6.30 | 0.88 | 3.87 | 1.16 | 5.09 | Not applicable | Not applicable | 1.16 | 5.09 | 5.09 |
| | | | | | PM10 | 0.14 | 0.60 | 0.08 | 0.35 | 0.11 | 0.48 | Not applicable | Not applicable | 0.11 | 0.48 | 0.48 |
| | | | | | PM2.5 | 0.14 | 0.60 | 0.08 | 0.35 | 0.11 | 0.48 | Not applicable | Not applicable | 0.11 | 0.48 | 0.48 |
| Id. 101, 101A 10-4 FCC UNIT | 1/07 thru 12/08 | 8625 | 8614 | 8619 | NOx | 287.53 | 1,259.40 | 259.99 | 1,138.77 | 273.76 | 1,199.09 | 92.30 | 92.30 | 92.30 | 92.30 | 92.30 |
| | | | | | SO2 | 693.45 | 3,037.30 | 626.65 | 2,744.74 | 660.05 | 2,891.02 | 128.38 | 128.38 | 128.38 | 128.38 | 128.38 |
| | | | | | VOC | 0.30 | 1.30 | 0.28 | 1.21 | 0.29 | 1.26 | Not applicable | Not applicable | 0.29 | 1.26 | 1.26 |
| | | | | | CO | 94.13 | 412.30 | 72.50 | 317.54 | 83.32 | 364.92 | Not applicable | Not applicable | 83.32 | 364.92 | 364.92 |
| | | | | | PM10 | 73.79 | 323.20 | 70.21 | 307.51 | 72.00 | 315.36 | Not applicable | Not applicable | 72.00 | 315.36 | 315.36 |
| | | | | | PM2.5 | 73.79 | 323.20 | 70.21 | 307.51 | 72.00 | 315.36 | Not applicable | Not applicable | 72.00 | 315.36 | 315.36 |
| | | | | | SO3 | 12.80 | 56.07 | 12.80 | 56.07 | 12.80 | 56.07 | Not applicable | Not applicable | 12.80 | 56.07 | 56.07 |
| Id. 040 10-4 FEED HTR | 1/07 thru 12/08 | 7344 | 3408 | 5376 | NOx | 4.77 | 20.90 | 1.09 | 4.79 | 2.93 | 12.85 | Not applicable | Not applicable | 2.93 | 12.85 | 12.85 |
| | | | | | SO2 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.01 | Not applicable | Not applicable | 0.00 | 0.01 | 0.01 |
| | | | | | VOC | 0.27 | 1.20 | 0.06 | 0.28 | 0.17 | 0.74 | Not applicable | Not applicable | 0.17 | 0.74 | 0.74 |
| | | | | | CO | 0.14 | 0.60 | 0.03 | 0.13 | 0.08 | 0.36 | Not applicable | Not applicable | 0.08 | 0.36 | 0.36 |
| | | | | | PM10 | 0.80 | 3.50 | 0.18 | 0.77 | 0.49 | 2.13 | Not applicable | Not applicable | 0.49 | 2.13 | 2.13 |
| | | | | | PM2.5 | 0.80 | 3.50 | 0.18 | 0.77 | 0.49 | 2.13 | Not applicable | Not applicable | 0.49 | 2.13 | 2.13 |
| Id. 705 | | | | | NOx | 1.10 | 4.80 | 1.25 | 5.49 | 1.17 | 5.14 | Not applicable | Not applicable | 1.17 | 5.14 | 5.14 |
| | | | | | SO2 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 | Not applicable | Not applicable | 0.00 | 0.01 | 0.01 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Id. 705 12-4 LSG HDS HTR | 1/07 thru 12/08 | 8746 | 7722 | 8234 | VOC | 0.03 | 0.15 | 0.03 | 0.11 | 0.03 | 0.13 | Not applicable | Not applicable | 0.03 | 0.13 | 0.13 |
| | | | | | CO | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | Not applicable | Not applicable | 0.00 | 0.01 | 0.01 |
| | | | | | PM10 | 0.04 | 0.16 | 0.10 | 0.42 | 0.07 | 0.29 | Not applicable | Not applicable | 0.07 | 0.29 | 0.29 |
| | | | | | PM2.5 | 0.04 | 0.16 | 0.10 | 0.42 | 0.07 | 0.29 | Not applicable | Not applicable | 0.07 | 0.29 | 0.29 |
| Id. 706 12-4 LSG STABILIZR HTR | 01/07 thru 12/08 | 8746 | 7722 | 8234 | NOx | 0.34 | 1.50 | 0.15 | 0.65 | 0.25 | 1.08 | Not applicable | Not applicable | 0.25 | 1.08 | 1.08 |
| | | | | | SO2 | 0.00 | 0.01 | 0.01 | 0.04 | 0.01 | 0.02 | Not applicable | Not applicable | 0.01 | 0.02 | 0.02 |
| | | | | | VOC | 0.03 | 0.15 | 0.00 | 0.01 | 0.02 | 0.08 | Not applicable | Not applicable | 0.02 | 0.08 | 0.08 |
| | | | | | CO | 0.11 | 0.50 | 0.03 | 0.12 | 0.07 | 0.31 | Not applicable | Not applicable | 0.07 | 0.31 | 0.31 |
| | | | | | PM10 | 0.04 | 0.16 | 0.03 | 0.15 | 0.04 | 0.16 | Not applicable | Not applicable | 0.04 | 0.16 | 0.16 |
| | | | | | PM2.5 | 0.04 | 0.16 | 0.03 | 0.15 | 0.04 | 0.16 | Not applicable | Not applicable | 0.04 | 0.16 | 0.16 |
| Id. 111* Cooling Towers | 01/07 thru 12/08 | N/A | N/A | N/A | VOC | 4.55 | 19.94 | 4.55 | 19.94 | 4.55 | 19.94 | Not applicable | Not applicable | 4.55 | 19.94 | 19.94 |
| | | N/A | N/A | N/A | PM10 | 2.29 | 10.03 | 2.39 | 10.45 | 2.34 | 10.24 | Not applicable | Not applicable | 2.34 | 10.24 | 10.24 |
| | | N/A | N/A | N/A | PM2.5 | 2.29 | 10.03 | 2.39 | 10.45 | 2.34 | 10.24 | Not applicable | Not applicable | 2.34 | 10.24 | 10.24 |
| | | | | | **NOx** | **406.60** | | | | | | | | | | |
| | | | | | **SO2** | **128.78** | | | | | | | | | | |
| **Total Allowable ERCs** | | | | | **VOC** | **35.19** | | | | | | | | | | |
| | | | | | **CO** | **564.71** | | | | | | | | | | |
| | | | | | **PM10** | **346.27** | | | | | | | | | | |
| | | | | | **PM2.5** | **346.27** | | | | | | | | | | |
| | | | | | **SO3** | **56.07** | | | | | | | | | | |

* Only includes following cooling towers: 10 Plant A an B, 12 Plant North and South, 17-1A, 17-2, 17-2A and LSG

All the emission sources included in this application were shutdown in December 2011.

Towers Calculations

| PM, ton / year | = | Recirc Rate, min | Drift Factor, 100 | 0.6 mg micromhos * L | Avg conduc # 454 g | g 1000 mg | ton 2000# | 3.78 L gal | 60 min hr | hr yr |
|---|---|---|---|---|---|---|---|---|---|---|

Drift factor for 15-2S = 0. (crossflow) assumption approved by Stacy Starr
Drift factor for LSG = 0.0 permit control efficiency is 99.998%. Therefore is .002% for drift factor from Marley data sheet.
Drift factor for remaining towers = 0.0 (counterflow)
Source: "Cooling Tower Fundamentals" pub by The Marley Cooling Twoer Co.
Source: TDS (mg/L) =0.6 * conductivity - Betz Handbook of Industrial Water Conditioning, 9 -uth- edition, 1991
Conductivity is measured monthly

| | | Annual sum of all cooling towers | | | VOC Emission Factor | | |
|---|---|---|---|---|---|---|---|
| VOC, ton / year | = | Design circulation rate, g mins | 60 mins hour | number of h year | 0.7 # Mmgal circu | Mmgal 10e6 gal | ton 2000# |

VOC - AP42 (Table 5.1-2) Emission Factor for controlled sources
Use design circulation rate as throughput, for both PM and VOC, except for LSG that has a flow meter

Sunoco Marcus Hook Refinery
ERC Registry Application
Section 6 - Baseline Emission Rate Summary
Greenhouse Gases in M-tons and S-tons
Attachment 2

Rev 08/08/12

2010

| Source Id. | CO2 | | CH4 | | N2O | | Total | | Total CO2e | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CO2 | CO2e | CH4 | CO2e | N2O | CO2e | M-tons | S-tons | M-tons | S-tons |
| 060 15-1 CRUDE HTR | 104,811.00 | 104,811.00 | 2.00 | 42.00 | 0.20 | 62.00 | 104,813.20 | 115,535.59 | 104,915.00 | 115,647.80 |
| 075 17-2A H-01, H-02, H-03 HTR | 41,538.00 | 41,538.00 | 0.72 | 15.10 | 0.08 | 24.80 | 41,538.80 | 45,788.22 | 41,577.90 | 45,831.32 |
| 078 17-2A H-04 HTR | 9,690.00 | 9,690.00 | 0.18 | 3.80 | 0.02 | 6.20 | 9,690.20 | 10,681.51 | 9,700.00 | 10,692.31 |
| 099 12-3 CRUDE HTR H-3006 | 89,661.00 | 89,661.00 | 2.00 | 42.00 | 0.20 | 62.00 | 89,663.20 | 98,835.75 | 89,765.00 | 98,947.96 |
| 045 12-3 DESULF HTR | 4,538.00 | 4,538.00 | 0.01 | 2.10 | 0.01 | 3.10 | 4,538.02 | 5,002.26 | 4,543.20 | 5,007.97 |
| 101 10-4 FCC UNIT | 788,305.30 | 788,305.30 | 23.18 | 486.78 | 4.64 | 1,438.40 | 788,333.12 | 868,979.60 | 790,230.48 | 871,071.06 |
| COB1 10-4 CO Boiler # 1 | 69,863.30 | 69,863.30 | 1.21 | 25.40 | 0.12 | 37.20 | 69,864.63 | 77,011.78 | 69,925.90 | 77,079.32 |
| COB3 10-4 CO Boiler # 3 | 27,775.20 | 27,775.20 | 0.52 | 10.90 | 0.05 | 15.50 | 27,775.77 | 30,617.23 | 27,801.60 | 30,645.70 |
| 040 10-4 FEED HTR | 2,064.30 | 2,064.30 | 0.04 | 0.80 | 0.00 | 1.20 | 2,064.34 | 2,275.53 | 2,066.30 | 2,277.68 |
| 705 12-4 LSG HDS HTR | 17,134.40 | 17,134.40 | 0.32 | 6.70 | 0.03 | 9.30 | 17,134.75 | 18,887.63 | 17,150.40 | 18,904.89 |
| 706 12-4 LSG STABILIZR HTR | 11,732.90 | 11,732.90 | 0.22 | 4.60 | 0.02 | 6.82 | 11,733.14 | 12,933.44 | 11,744.32 | 12,945.76 |
| **Totals** | 1,167,113.40 | 1,167,113.40 | 30.40 | 640.18 | 5.37 | 1,666.52 | 1,167,149.17 | 1,286,548.53 | 1,169,420.10 | 1,289,051.78 |

2011

| Source Id. | CO2 | | CH4 | | N2O | | Actual Total | | Total CO2e | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CO2 | CO2e | CH4 | CO2e | N2O | CO2e | M-tons | S-tons | M-tons | S-tons |
| 060 15-1 CRUDE HTR | 96,570.10 | 96,570.10 | 1.85 | 38.90 | 0.19 | 58.90 | 96,572.14 | 106,451.47 | 96,667.90 | 106,557.03 |
| 075 17-2A H-01, H-02, H-03 HTR | 39,869.60 | 39,869.60 | 0.73 | 15.30 | 0.08 | 24.80 | 39,870.41 | 43,949.15 | 39,909.70 | 43,992.46 |
| 078 17-2A H-04 HTR | 5,264.30 | 5,264.30 | 0.10 | 2.10 | 0.01 | 3.10 | 5,264.41 | 5,802.96 | 5,269.50 | 5,808.57 |
| 099 12-3 CRUDE HTR H-3006 | 77,227.20 | 77,227.20 | 1.63 | 34.20 | 0.16 | 49.60 | 77,228.99 | 85,129.52 | 77,311.00 | 85,219.92 |
| 045 12-3 DESULF HTR | 4,195.80 | 4,195.80 | 0.08 | 1.70 | 0.01 | 3.10 | 4,195.89 | 4,625.13 | 4,200.60 | 4,630.32 |
| 101 10-4 FCC UNIT | 791,217.30 | 791,217.30 | 23.26 | 488.46 | 4.65 | 1,441.50 | 791,245.21 | 872,189.59 | 793,147.26 | 874,286.22 |
| COB1 10-4 CO Boiler # 1 | 67,146.10 | 67,146.10 | 1.27 | 26.70 | 0.13 | 40.30 | 67,147.50 | 74,016.69 | 67,213.10 | 74,089.00 |
| COB3 10-4 CO Boiler # 3 | 33,684.10 | 33,684.10 | 0.65 | 13.70 | 0.07 | 21.70 | 33,684.82 | 37,130.78 | 33,719.50 | 37,169.00 |
| 040 10-4 FEED HTR | 5,532.30 | 5,532.30 | 1.85 | 38.90 | 0.19 | 58.90 | 5,534.34 | 6,100.50 | 5,630.10 | 6,206.06 |
| 705 12-4 LSG HDS HTR | 15,935.50 | 15,935.50 | 0.31 | 6.50 | 0.03 | 9.60 | 15,935.84 | 17,566.08 | 15,951.60 | 17,583.45 |
| 706 12-4 LSG STABILIZR HTR | 9,982.30 | 9,982.30 | 0.22 | 4.60 | 0.02 | 6.20 | 9,982.54 | 11,003.75 | 9,993.10 | 11,015.39 |
| **Totals** | 1,146,624.60 | 1,146,624.60 | 31.95 | 671.06 | 5.54 | 1,717.70 | 1,146,662.09 | 1,263,965.62 | 1,149,013.36 | 1,266,557.43 |

ERC Summary

| Year | Parameter, M-tons | | | | | | Total Actual | | Total CO2e | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CO2 | | CH4 | | N2O | | M-tons | S-tons | M-tons | S-tons |
| | CO2 | CO2e | CH4 | CO2e | N2O | CO2e | | | | |
| 2010 | 1,167,113.40 | 1,167,113.40 | 30.40 | 640.18 | 5.37 | 1,666.52 | 1,167,149.17 | 1,286,548.53 | 1,169,420.10 | 1,289,051.78 |
| 2011 | 1,146,624.60 | 1,146,624.60 | 31.95 | 671.06 | 5.54 | 1,717.70 | 1,146,662.09 | 1,263,965.62 | 1,149,013.36 | 1,266,557.43 |
| Average | 1,156,869.00 | 1,156,869.00 | 31.18 | 655.62 | 5.46 | 1,692.11 | 1,156,905.63 | 1,275,257.08 | 1,159,216.73 | 1,277,804.60 |

| Requested ERCs | CO2 | | CH4 | | N2O | | Total | Total |
|---|---|---|---|---|---|---|---|---|
| | CO2 | CO2e | CH4 | CO2e | N2O | CO2e | Actual | CO2e |
| M-tons | **1,156,869.00** | **1,156,869.00** | **31.18** | **655.62** | **5.46** | **1,692.11** | **1,156,905.63** | **1,159,216.73** |
| S-tons | **1,275,216.70** | **1,275,216.70** | **34.36** | **722.69** | **6.02** | **1,865.21** | **1,275,257.08** | **1,277,804.60** |

Sunoco Marcus Hook Refinery
ERC Registry Application
Section 8 - Emission Characteristics

| Source | (a) | (b) | (c) | (d) | (e) | (g) | |
|---|---|---|---|---|---|---|---|
| | Hours of operation | Hourly Rate | Stack Height (from ground level) | Stack Inside Diameter | Exhaust Volume | Seasonal Period (months) Operated | |
| 15-1 CRUDE HTR | 8496 | 249 MMBtu/hr | 100 feet | 7.5 feet | 42,476 scfm | Not applicable | Not applicable |
| 17-2A H-01, H-02, H-03 HTR | 8580 | 213 MMBtu/hr | 91 feet | 7 feet | 38,280 scfm | Not applicable | Not applicable |
| 17-2A H-04 HTR | 8472 | 40 MMBtu/hr | 90 feet | 5 feet | 3,959 scfm | Not applicable | Not applicable |
| 12-3 CRUDE HTR H-3006 | 8484 | 249 MMBtu/hr | 150 feet | 7.5 feet | 73,600 scfm | Not applicable | Not applicable |
| 12-3 DESULF HTR | 7344 | 34 MMBtu/hr | 80 feet | 3 feet | 5,129 scfm | Not applicable | Not applicable |
| 10-4 FCC UNIT | 8619.24 | 4,792 Bbl/hr | 120 feet | 15 feet | 290,000 scfm | Not applicable | Not applicable |
| 10-4 FEED HTR | 5376 | 120 MMBtu/hr | 175 feet | 8 feet | 18,771 scfm | Not applicable | Not applicable |
| LSG HDS HTR | 8234 | 97 MMBtu/hr | | 5 feet | | Not applicable | Not applicable |
| LSG STABILIZR HTR | 8234 | 53 MMBtu/hr | | 3 feet | | Not applicable | Not applicable |
| Cooling Towers | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable |

# *Marcus Hook Facility GHG Monitoring Plan*
# *Document Number: RS-MH-ENV-STD-GHG Monitoring Plan*

| | |
|---|---|
| ***Control Tier:*** | ***Document Authorizer:*** |
| ***2 – Refining and Supply*** | ***MH Environmental Manager*** |
| ***Issuing Dept:*** | ***Document Reviewer:*** |
| ***R&S Environmental*** | ***MH Facility GHG Team*** |
| ***Revision Date:*** | ***Document Author:*** |
| ***03/08/2012*** | ***MH Environmental Specialist*** |
| ***Next Review Date:*** | ***Document Administrator:*** |
| ***03/08/2013*** | ***MH Environmental Document Control Coordinator*** |

## *1.0 Purpose/Scope*

This protocol applies to the *Marcus Hook* Facility, effective April 1, 2010. The purpose is to meet the EPA Greenhouse Gas (GHG) Reporting Rule, which specifically details a requirement for a GHG Monitoring Plan. Currently the Refinery is in an "idled" state. Most of the combustion sources are down as of the late 4th quareter of 2011. This manual will remain unchanged for this time as the reporting for 2011 will reflect the running refinery. In the next revision most likely refinery and combustion sources will be updated to reflect the "idled"state of operation. Also the orgaininzation will change to reflect the new roles & responsibilities

## *2.0 Definitions*

Refer to PSG-OEMS-STD-019 *Definitions* for definitions common to this standard, in addition to the definitions found in ENV-STD-XXX, *Mandatory Green House Gas Reporting Rule (40 CFR Part 98).*

## *3.0 General Requirements*

Individual facilities have the responsibility of compliance with the Mandatory EPA GHG Reporting Rule for the collection and reporting of GHGs (Refer to ENV-STD-XXX, Mandatory Green House Gas Reporting Rule - 40CFR Part 98). This document is intended to outline the Marcus Hook Refinery monitoring plan, as required per § 98.3 (g)(5)(i).

Annual reports are due to be submitted to the EPA by March 31 for the preceding year. A designated representative at the facility is responsible for certifying, signing, and submitting GHG emissions reports. If the facility is required to submit any other emissions report that is subject to any requirements in 40CFR part 75, the same individual shall be the designated representative.

## *4.0 Key Responsibilities*

**Facility Managers –** Designate resources to ensure the applicable requirements of the procedure are followed and that site-specific procedures exist and are accurate.

**Environmental Supervisor/Manager –** Designate resources and ensure the requirements of this procedure are followed.

**Environmental Engineer/Specialist –** Responsible to be familiar with and comply with this procedure. This person is also responsible for providing the information so that the designated representative can submit the yearly report to the EPA.

**Facility Energy Coordinator –** Designated as the Champion of the Facility GHG Team. Responsible for assembling all necessary data, calculations, recordkeeping requirements and results as laid out in the Mandatory GHG Reporting Rule.

**Facility Maintenance Contact –** Responsible for the maintenance records for all continuous monitoring systems, flow meters, and other instrumentation used to provide data for the GHGs reported under this Rule.

**Facility Accounting Contact –** Responsible for ensuring accuracy with all yield accounting functions contained within the Reporting Rule, including raw material and product data.

## *5.0 Procedure/Process*

### 5.1 Source List

Below is a list of all units, operations, processes, and activities for which GHG emissions are calculated per the Reporting Rule:

| Unit | Equipment | Subpart |
|---|---|---|
| 15-1 | H-3 Heater | C |
| 12-3 | H-3006 Heater | C |
| 12-3 | H-102 HDS Heater | C |
| 12-4 | Heaters H01 & H02 | C |
| 10-4 | Light Recycle Heater | C |
| 10-4 | #1 & #3 CO Boilers | C |
| 16 Boiler house | A, B, C & D Boilers | C |
| 17-1P | H-81 Heater (East & West) | C |
| 17-2a | Reformer Heater (H01/02/03) | C |
| 17-2a | Reformer Heater (H04) | C |
| 17-6 | SRU incinerators (East & West) | C |
| 17-6 | SRU Fuel Gas Burning (E & W) | C |
| 12-3 | 12-3 Flare | Y |
| 10-4 | 10-4 Flare | Y |
| EC | EC Flare | Y |

| | | |
|---|---|---|
| 10-4 | FCCU Coke | Y |
| 17-6 | Sulfur Plants w tailgas units | Y |
| 17-2a | Catalytic Reforming | Y |
| Facility Wide | Equipment Leaks | Y |
| Facility Wide | Storage Tanks | Y |
| Facility Wide | Loading (Marine, Railcar Truck) | Y |
| Facility Wide | Product Transfers | MM |

## 5.2 Data Collection Procedure

*5.2.1 Subpart C – Combustion Sources*

Refer to Appendix B for a full list of information regarding these sources. All instruments are calibrated in accordance with the Reporting Rule. Calibration records are maintained on-site by the Maintenance Department. Operating data is stored on the facilities Data Acquisition system. The Facility Energy Coordinator is responsible for ensuring all data for this source is accurate and available; if accurate date is missing, the Energy Coordinator is responsible to backfill missing data according to the Missing Data requirements, as established in The Rule.

*5.2.2 Subpart Y – Petroleum Refineries*

Refer to Appendix C for a full list of information regarding these sources. All instruments are calibrated in accordance with the Reporting Rule. Calibration records are maintained on-site by the Maintenance Department. Operating data is stored on the facilities Data Acquisition system. The Facility Energy Coordinator is responsible for ensuring all data for this source is accurate and available; if accurate date is missing, the Energy Coordinator is responsible to backfill missing data according to the Missing Data Requirements, as established in The Rule.

For Flare systems without a functioning flow meter or routine sample schedule (10 plant & 12 Plant flares), the following engineering calculations are used to determine the amount of flare gas combusted during normal operations:

The normal flows & heating values are determined by the most recent stack test data.

Engineering judgment & process knowledge is used to determine the flows and heating values during an SSM event. For example if a shutdown of the #1 Clark Compressor results in flaring at 10 plant a good faith estimate of the flow and heating value of the #1 Clark prior to the shutdown may be used to best estimate the increased flow to the flare during the SSM event. The SSM events will be aggregated with the normal flare flows in determining total flare flows.

For Flare Systems with a functioning flow meter and a routine sample schedule (EC or Main Flare), the Equation Y-1 is used to calculate $CO_2$ emissions.

*5.2.3 Subpart MM – Petroleum Products*

Refer to Appendix D for a full list of information regarding these sources. All instruments are calibrated in accordance with the Reporting Rule. Records are maintained on-site by the Maintenance Department. Data is stored on the facilities Data Acquisition system. The Facility Energy Coordinator is responsible for ensuring all data for this source is accurate and available; if accurate date is missing, the Energy Coordinator is responsible to backfill missing data according to the Missing Data requirements, as established in The Rule.

### 5.3 Quality Assurance/Maintenance/Repair of GHG Instrumentation

In the appendixes B, C & D are list of the instrument used in the Green House Gas calculations. Those instruments are calibrated as per the frequency denoted in the appendix. The calibration procedures are denoted on the detailed calibration worksheet for each instrument.

All instruments (Tier II & Tier III) used in Green House Gas calculations are also subject to Sunoco Maintenance Work Practice Standards. These standards allow the initiation of work orders, planning and execution of instrument repairs. Information around instruments used in Tier II sources (generally natural gas) are also retained as company records.

## *6.0 Revisions*

Revisions to this protocol shall be reviewed by the R&S Environmental Forum and approved by the Document Authorizer – see attached Revision Log

## *7.0 Key Documents/Tools/Reference (List of Attachments)*

- 40 CFR 98.3 (g)(5)(i)
- PSG-OEMS-STD-019 *Definitions*
- ENV-STD-XXX (to be determined issued by Sean Finnegan in draft form)
- 40 CFR 98 Subpart A – General Provisions
- 40 CFR 98 Subpart C – Combustion Sources
- 40 CFR 98 Subpart Y – Petroleum Refineries
- 40 CFR 98 Subpart MM – Supplier of Petroleum Products

## *Revision Log*

| *Revision Date* | *Document Authorizer* | *Document Reviewer* | *Document Author* | *Revision Details* |
|---|---|---|---|---|
| 03/24/10 | R. V. Lanouette | S. Finnegan<br>S. Hamilton<br>R. V. Lanouette | P. J. Braun | Initial Issue |
| 08/10/10 | P. K. Johnston | P. K. Johnston | P. J. Braun | Added formulas for $CH_4$ & $N_2O$ throughout |

**Appendix A. GHG Emissions Calculations and Methods Used**

For all Subpart C, Tier 2 Sources at the facility, the following equations are used:

$$CO_2 = 1x10^{-3} * Fuel * HHV_{avg} * EF \quad \text{(Eq. C-2a)}$$

Where:

$CO_2$ = Annual $CO_2$ mass emissions for a specific fuel type (metric tons)
Fuel = Mass or volume of the fuel combusted during the year, from company records (express mass in short tons for solid fuel, volume in standard cubic feet for gaseous fuel and volume in gallons for liquid fuel).
$HHV_{avg}$ = Annual average high heat value of the fuel from all valid samples for the year (mmBTU per mass or volume)
EF = Fuel-specific default $CO_2$ emission factor from Table C-1

For the $CH_4$ and $N_2O$ portion of Tier 2 Sources use:

$$CH_4 \text{ or } N_2O = 1 \times 10^{-3} \times HHV \times EF \times Fuel \quad \text{(Eq. C-9a)}$$

Where:

$CH_4$ or $N_2O$ = Annual $CH_4$ or $N_2O$ emissions from the combustion of a particular type of fuel (metric tons).
Fuel = Mass or volume of the fuel combusted during the reporting year.
HHV = High heat value of the fuel, averaged for all valid measurements for the reporting year (mmBtu per mass or volume).
EF = Fuel-specific default emission factor for $CH_4$ or $N_2O$, from Table C–2 from the GHG rule (kg $CH_4$ or $N_2O$ per mmBtu).
$1 \times 10^{-3}$= Conversion factor from kilograms to metric tons.

For all Subpart C, Tier 3 Sources at the facility, the following equations are used for gaseous fuels:

$$CO_2 = \frac{44}{12} \times Fuel \times CC \times \frac{MW}{MVC} \times 0.001 \quad \text{(Eq. C-5)}$$

Where:

$CO_2$ = Annual $CO_2$ mass emissions for a specific fuel type (metric tons)
Fuel = Annual volume of the gaseous fuel combusted during the year (scf). The volume of fuel must be measured directly, using fuel flow meters calibrated according to 98.3(i). Fuel billing meters may be used for this purpose.
CC = Annual average carbon content of the fuel (kg C per **Kg** ~~gallon~~ of fuel).
MW = Annual average molecular weight of the gaseous fuel (kg/kg mole).
MVC = Molar volume conversion factor (849.5 scf per kg-mole @ standard conditions).
44/12 = Ratio of molecular weights, CO2 to carbon.
**0.01** = Conversion factor from kg to metric tons.

For the $CH_4$ & $N_2O$ portion of Tier 3 sources use**;**

$$CH_4 \text{ or } N_2O = 1 \times 10^{-3} \times \text{Fuel} \times \text{HHV} \times \text{EF} \quad \text{(Eq. C-8)}$$

Where:

$CH_4$ or $N_2O$ = Annual $CH_4$ or $N_2O$ emissions from the combustion of a particular type of fuel (metric tons).
Fuel = Mass or volume of the fuel combusted, either from company records or directly measured by a fuel flow meter, as applicable (mass or volume per year).
HHV = Default high heat value of the fuel from Table C–1 of the GHG rule (mmBtu per mass or volume).
EF = Fuel-specific default emission factor for $CH_4$ or $N_2O$, from Table C–2 of this subpart (kg $CH_4$ or $N_2O$ per mmBtu).
$1 \times 10^{-3}$ = Conversion factor from kilograms to metric tons.

For Subpart Y, the FCCU Coke calculations, the following equations are used:

$$CO_2 = \sum_{p=1}^{n}\left[(Qr)_p \times \frac{(\%CO_2 + \%CO)_p}{100\%} \times \frac{44}{MVC} \times 0.001\right] \quad \text{(Eq. Y-6)}$$

Where:

$$Q_r = \frac{(79 * Q_a)}{100 - \%CO_2 - \%CO - \%O_2} \quad \text{(Eq. Y-7)}$$

And:

**$CO_2$** = Annual $CO_2$ mass emissions (metric tons)
**$Q_r$** = Volumetric flow rate of exhaust gas from the fluid catalytic cracking unit regenerator prior to the combustion of other fossil fuels.
**%$CO_2$ =** Hourly average percent $CO_2$ concentration in the exhaust gas stream from the FCCU regenerator (percent by volume – dry basis)
**%CO =** Hourly average percent CO concentration in the exhaust gas stream from the FCCU regenerator (percent by volume – dry basis). When there is no post-combustion device, assume %CO to be zero.
**44 =** Molecular weight of $CO_2$ (kg/kg-mole)
**MVC =** Molar volume conversion factor (849.5 scf/kg-mole)
**0.001 =** Conversion factor (metric ton/kg)
**$Q_a$ =** Volumetric flow rate of air to the FCCU regenerator, as determined from control room instrumentation (dscfh).
**$Q_{oxy}$ =** Volumetric flow rate of oxygen enriched air to the FCCU regenerator as determined from control room instrumentation (dscfh).
**%$O_2$ =** Hourly average percent oxygen concentration in exhaust gas stream from the FCCU (percent by volume – dry basis).
**%$O_{oxy}$** = $O_2$ concentration in oxygen enriched gas stream inlet to the FCCU based on oxygen purity specifications of the oxygen supply used for enrichment (percent by volume – dry basis).
**n =** Number of hours in calendar year

For the $CH_4$ and $N_2O$ portion use:

$$CH_4 = [CO_2 \text{ x } EMF_2/EmF_1] \quad \text{(Eq. Y-9)}$$

Where:

$CH_4$= Annual methane emissions from coke burn-off (metric tons $CH_4$/year).

$CO_2$= Emission rate of $CO_2$ from coke burn-off (metric tons/year).

$EmF_1$= Default $CO_2$ emission factor for petroleum coke from Table C–1 of GHG rule (General Stationary Fuel Combustion Sources) (kg $CO_2$ /MMBtu).

$EMF_2$ = Default $CH_4$ emission factor for "PetroleumProducts" from Table C–2 of the GHG rule (General Stationary Fuel Combustion Sources) (kg $CO_2$ /MMBtu).

Calculate $N_2O$ emissions using Equation Y–10;

$$N_2O = [CO2 \text{ x } EmF_3/EmF_1] \quad \text{(Eq. Y-10)}$$

Where:

$N_2O$ = Annual nitrous oxide emissions from coke burn-off (mt $N_2O$/year).

$CO_2$= Emission rate of $CO_2$ from coke burn-off calculated (metric tons/year).

$EmF_1$= Default $CO_2$ emission factor for petroleum coke from Table C–1 of the GHG rule t(General Stationary Fuel Combustion Sources) (kg $CO_2$/MMBtu).

$EmF_3$ - Default $N_2O$ emission factor for "PetroleumProducts" from Table C–2 of the GHG rule (kg $N_2O$ /MMBtu).

For Subpart Y, Equipment leaks of CH4 are calculated from the following equation:

$$CH_4 = (0.4 \times N_{CD} + 0.2 \times N_{PU1} + 0.1 \times N_{PU2} + 4.3 \times N_{H2} + 6 \times N_{FGS}) \quad \text{(Eq. Y-21)}$$

Where:

**$CH_4$** = Annual $CH_4$ emissions from equipment leaks (metric tons/year)
**$N_{CD}$** = Number of atmospheric crude oil distillation columns at the facility
**$N_{PU1}$ =** Cumulative number of catalytic cracking units, coking units (delayed or fluid), hydrocracking, and full-range distillation columns (including depropanizer and debutanizer distillation columns) at the facility
**$N_{PU2}$ =** Cumulative number of hydrotreating/hydrorefining units, catalytic reforming units, and visbreaking units at the facility.
**$N_{H2}$ =** Total number of hydrogen plants at the facility.
**$N_{FGS}$ =** Total number of fuel gas systems at the facility.

For Subpart Y, Flare Calculations, the following equations are used:

For the EC with a flow meter calculate the $CO_2$ emissions using Equation Y–1

$$CO_2 = 0.98 \times 0.001 \times \left( \sum_{p=1}^{n} \left[ \frac{44}{12} \times (Flare)_p \times \frac{(MW)_p}{MVC} \times (CC)_p \right] \right) \qquad \text{(Eq. Y-1)}$$

Where:

**$CO_2$**= Annual $CO_2$ emissions for a specific fuel type (metric tons/year).
**0.98** = Assumed combustion efficiency of a flare.
**0.001** = Unit conversion factor (metric tons per kilogram, mt/kg).
**n** = Number of measurement periods. The minimum value for n is 52 (for weekly measurements); the maximum value for n is 366 (for daily measurements during a leap year).
**p** = Measurement period index.
**44** = Molecular weight of $CO_2$(kg/kg-mole).
**12** = Atomic weight of C (kg/kg-mole).
**$(Flare)_p$**= Volume of flare gas combusted during measurement period (standard cubic feet per period, scf/period). If a mass flow meter is used, measure flare gas flow rate in kg/period and replace the term "$(MW)_p$/MVC" with "1".
**$(MW)_p$**= Average molecular weight of the flare gas combusted during measurement period (kg/kg-mole). If measurements are taken more frequently than daily, use the arithmetic average of measurement values within the day to calculate a daily average.
**MVC** = Molar volume conversion factor (849.5 scf/kg-mole).
**$(CC)_p$**= Average carbon content of the flare gas combusted during measurement period (kg C per kg flare gas). If measurements are taken more frequently than daily, use the arithmetic average of measurement values within the day to calculate a daily average.

For the 10 & 12 plant flares without a flow meter calculate the $CO_2$ emissions using Equation Y–3

$$CO_2 = 0.98 \times 0.001 \times \left( Flare_{Norm} \times HHV \times EmF + \sum_{p=1}^{n} \left[ \frac{44}{12} \times (Flare_{SSM})_p \times \frac{(MW)_p}{MVC} \times (CC)_p \right] \right)$$

(Eq. Y-3)

Where:

**$CO_2$** = Annual $CO_2$ emissions (metric tons/year)
**0.98** = Assumed combustion efficiency of a flare
**0.001 =** Unit conversion factor (metric tons per kilogram, mt/kg)
**$Flare_{Norm}$ =** Annual volume of flare gas combusted during normal operations from company records, (million (MM) standard cubic feet per year, MMscf/year)
**HHV =** Higher heating value for fuel gas or flare gas from company records (BTU/scf = MMBtu/MMscf)
**EmF =** Default $CO_2$ emission factor for flare gas of 60 kilograms $CO_2$/MMBtu (HHV Basis)
**n =** Number of startup, shutdown, and malfunction events during the reporting year exceeding 500,000 scf/day.
**p =** Start-up, shutdown, and malfunction index.
**44 =** Molecular weight of $CO_2$ (kg/kg-mole)
**12 =** Atomic weight of C (kg/kg-mole)
**$(Flare_{SSM})_p$=**Volume of flare gas combusted during indexed start-up, shutdown, or malfunction event from engineering calculations, (scf/event)
**$(MW)_p$=** Average molecular weight of the flare gas, from the analysis results or engineering calculations for the event (kg/kg-mole)

**MVC =** Molar volume conversion factor (849.5 scf/kg-mole).
**$(CC)_p$ =** Average carbon content of the flare gas, from analysis results or engineering calculations for the event (kg C per kg flare gas)

$$CH_4 = \left( CO_2 \times \frac{EmF_{CH4}}{EmF} \right) + CO_2 \times \frac{0.02}{0.98} \times \frac{16}{44} \times f_{CH4} \quad \text{(Eq. Y-4)}$$

Where:

**$CH_4$** = Annual methane emissions from flared gas (metric tons/year)
**$CO_2$** = Emissions rate of $CO_2$ from flared gas calculated from Eq. Y-3 (metric tons/year)
**$EmF_{CH4}$ =** Default $CH_4$ emission factor for "Petroleum Products" from Table C-2 of subpart C (kg $CH_4$/MMBTU)
**EmF =** Default $CO_2$ emission factor for flare gas of 60 kilograms $CO_2$/MMBtu (HHV Basis)
**0.02/0.98 =** Correction factor for flare combustion efficiency.
**16/44 =** Correction factor ratio of the molecular weights of $CH_4$ to $CO_2$.
**$f_{CH4}$ =** Weight fraction of carbon in the flare gas prior to combustion that is contributed by methane from measurement values or engineering calculations (kg C in methane in flare gas/kg C in flare gas); default is 0.4.

$$N_2O = \left( CO_2 \times \frac{EmF_{N2O}}{EmF} \right) \quad \text{(Eq. Y-5)}$$

Where:

**$N_2O$** = Annual nitrous oxide emissions from flared gas (metric tons/year)
**$CO_2$** = Emissions rate of $CO_2$ from flared gas calculated from Eq. Y-3 (metric tons/year)
**$EmF_{N2O}$ =** Default $N_2O$ emission factor for "Petroleum Products" from Table C-2 of subpart C (kg $N_2O$/MMBTU)
**EmF =** Default $CO_2$ emission factor for flare gas of 60 kilograms $CO_2$/MMBtu (HHV Basis)

For Subpart Y Catalytic Reforming unit catalyst regenerator the following equation is used:

$$CO_2 = \sum_{1}^{n} \left[ \left( CB_Q \right)_n \times CC \times \frac{44}{12} \times 0.001 \right] \qquad \text{(Eq. Y-11)}$$

Where:

$CO_2$= Annual $CO_2$ emissions (metric tons/year).
$CB_Q$= Coke burn-off quantity per regeneration cycle from engineering estimates (kg coke/cycle).
n = Number of regeneration cycles in the calendar year.
CC = Carbon content of coke based on measurement or engineering estimate (kg C per kg coke); default = 0.94.
44/12 = Ratio of molecular weight of $CO_2$ to C (kg $CO_2$ per kg C).
0.001 = Conversion factor (metric ton/kg).

For Subpart Y Sulfur Recovery Unit the following equation is used:

$$CO2 = F_{sg} \times 44/MVC \times MF_c \times .001 \qquad \text{(Eq. Y-12)}$$

Where:

$CO_2$= Annual $CO_2$ emissions (metric tons/year).

$F_{SG}$= Volumetric flow rate of sour gas feed (including sour water stripper gas) to the sulfur recovery plant (scf/year).

44 = Molecular weight of $CO_2$(kg/kg-mole).

MVC = Molar volume conversion factor (849.5 scf/kg-mole).

$MF_C$= Mole fraction of carbon in the sour gas to the sulfur recovery plant (kg-mole C/kg-mole gas); default = 0.20.

0.001 = Conversion factor, kg to metric tons.

## Appendix B – Subpart C Combustion Sources

| Source ID | HHV Rating (MMBtu/hr) | Fuel | Fuel Measurement | Fuel Analysis | Tier | Emissions Equation[1] | Calibration Frequency | Equation Inputs |
|---|---|---|---|---|---|---|---|---|
| H-3 (15-1) | >250 | RFG | Orifice Plate | Lab Sampling weekly | 3 | C-5 & C-8 | annual<br>annual<br>annual | ECV5271 Fuel Gas to H-3<br>ETI9202 Temperature Correction for H-3<br>EPC9203 Pressure Correction for H-3 |
| H-3 (15-1) | >250 | Natural Gas | | Supplier Values | 2 | | N/R | EFI5211 natural Gas to H-3 |
| H-3006 (12-3 Unit) | >250 | RFG | Orifice Plate | Lab Sampling weekly | 3 | C-5 & C-8 | annual<br>annual<br>annual | AFC1038- Fuel Gas to H-3<br>ATI1544 Temp. Correction for H-3<br>APC1026 Pressure Correction for H-3 |
| H-3006 (12-3 Unit) | >250 | Natural Gas | | Supplier Values | 2 | | N/R | AFI-1028 Natural Gas to H-3006 |
| H-102 (12-3 Unit) | <250 | RFG | Orifice Plate | Lab Sampling weekly | 3 | C-5 & C-8 | annual<br>annual<br>annual | AFI4006 Fuel gas to H-102<br>ATI1544 Temp. Correction<br>APC1026 Pressure Correction |
| H-01 (12-4 LSG unit) | <250 | RFG | | Lab Sampling weekly | 3 | C-5 & C-8 | annual<br>annual<br>annual | 24FR109C Fuel gas to H-01<br>24TR254 Temp Correction<br>24PC186 Pressure Correction |
| H-02 (12-4 LSG unit) | <250 | RFG | | Lab Sampling weekly | 3 | C-5 & C-8 | annual<br>annual<br>annual | 24FR154C Fuel gas to H-02<br>24TR254 Temp Correction<br>24PC186 Pressure Correction |

[1] See Appendix A for required equations.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Lt Recycle Heater<br>(FCC unit) | < 250 | RFG | Orifice Plate | Lab Sampling<br>weekly | 3 | C-5 & C-8 | annual<br>annual<br>annual | BFI676 Fuel Gas to Lt. Recycle<br>BTI2010 Temp. Correction Lt. Recycle<br>BPI 606 Pressure Correction |
| #1 COB<br>(FCC unit) | <250 | RFG | | Lab Sampling<br>weekly | 3 | C-5 & C-8 | annual<br>annual<br>annual | BFI605 Fuel Gas to #1 COB<br>BTI2010 Temp Correction<br>BPI606 Pressure Correction |
| FCC Unit - #3 COB | <250 | RFG | | Lab Sampling<br>weekly | 3 | C-5 & C-8 | annual<br>annual<br>annual | BFC2590 Fuel Gas to #3 COB<br>BTI2599 Temp Correction<br>BPI2589 Pressure Correction |
| 17-1P<br>H-81<br>(17 Plant)<br>17-1P | <250<br><br><br><250 | RFG<br><br><br>NG | | Lab Sampling<br>weekly<br><br>Supplier Values | 3<br><br><br>2 | C-5 & C-8 | annual<br>annual<br>annual<br>N/R | NFI4005 Fuel Gas to 17-1P<br>MTI8093 Temp Correction<br>EPC9203 Pressure Correction<br>NFI1226 natural Gas to 17-1P |
| 17-2A H1/2/3<br>(17 Plant)<br>This is a common heater box | <250 | RFG | Orifice Plate<br>Orifice Plate<br>Orifice Plate | Lab Sampling<br>weekly | 3 | C-5 & C-8 | annual<br>annual<br>annual<br>annual<br>annual | QFC6012 H01 flow gas flow<br>QFC6013 H02 fuel gas flow<br>QFC6014 H03 fuel gas flow<br>MTI8093 Temperature correction<br>QPI6015 Pressure correction |
| 17-2A H04 | <250 | RFG | Orifice Plate<br>Orifice Plate | Lab Sampling<br>weekly | 3 | C-5 & C-8 | annual<br>annual<br>annual<br>annual | QFC6028 Fuel Gas to H04 A<br>QFC6029 Fuel Gas to H04 B<br>MTI8093 Temperature Correction<br>EPC9203 Pressure Correction |
| 17-6<br>SRU #1 Incinerator | <250 | NG | Orifice Plate | Supplier Values | 2 | C-2a & C-9a | N/R | CFI7425C Natural Gas to incinerator #1<br>MTI8093 Temperature Correction |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 17-6<br>SRU #1 fuel | <250 | NG | Vortex | Supplier Values | 2 | C-2a & C-9a | N/R | CFC8405 Natural Gas to SRU #1<br>MTI8093 Temperature Correction |
| 17-6<br>SRU #2 Incinerator | <250 | NG | Orifice Plate | Supplier Values | 2 | C-2a & C-9a | annual | DFI7425 Natural Gas to incinerator #2<br>MTI8093 Temperature Correction |
| 17-6<br>SRU #2 fuel | <250 | NG | Vortex | Supplier Values | 2 | C-2a & C-9a | annual | DFI8405 Natural Gas to SRU #2<br>MTI8093 Temperature Correction |
| 16 BH<br>A Boiler | >250 | RFG | | Lab Sampling<br>weekly | 3 | C-5 & C-8 | <annual<br><annual<br><annual | XGFI720A mass flow meter for RFG to A blr<br>XGTI725A Temp correction for A Boiler RFG<br>XGPI722A Press correction for A Boiler RFG |
| 16 BH<br>A Boiler | >250 | NG | | Supplier Values | 2 | C-2a & C-9a | <annual<br><annual<br><annual | XGFI700A mass flow meter for NG to #A blr<br>XGTI705A Temp correction for A Boiler NG<br>XGPI702A Press correction for A Boiler NG |
| 16 BH<br>B Boiler | >250 | RFG | | Lab Sampling<br>weekly | 3 | C-5 & C-8 | <annual<br><annual<br><annual | XGFI720B mass flow meter for RFG to #B blr<br>XGTI725B Temp correction for B Boiler RFG<br>XGPI722B Press correction for B Boiler RFG |
| 16 BH<br>B Boiler | >250 | NG | | Supplier Values | 2 | C-2a & C-9a | <annual<br><annual<br><annual | XGFI700B mass flow meter for NG to #B blr<br>XGTI705B Temp correction for NG to #B blr<br>XGPI702B Press correction for NG to #B blr |
| 16 BH<br>C Boiler | >250 | RFG | | Lab Sampling<br>weekly | 3 | C-5 & C-8 | <annual<br><annual<br><annual | XGFI720 C mass flow meter for RFG #C blr<br>XGTI725C Temp correction for RFG #C blr<br>XGPI722C Press correction for RFG #C blr |
| 16 BH<br>C Boiler | >250 | NG | | Supplier Values | 2 | C-2a & C-9a | <annual<br><annual | XGIF700C mass flow meter for NG to #C blr<br>XGTI705C Temp correction for NG to #C blr |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | <annual | XGPI702C Press correction for NG to #C blr |
| 16 BH | >250 | RFG | | Lab Sampling | 3 | C-5 & C-8 | <annual | XGIF720D mass flow meter for RFG to #D blr |
| D Boiler | | | | weekly | | | <annual | XGTI725D Temp correction for RFG to #D blr |
| | | | | | | | <annual | XGPI722D Press correction for RFG to #D blr |
| 16 BH | >250 | NG | | Supplier Values | 2 | C-2a & C-9a | <annual | XGIF700D mass flow meter to NG to #D blr |
| D Boiler | | | | | | | | XGTI705D Temp correction for NG to #D blr |
| | | | | | | | | XGPI702D Press correction for NG to #D blr |
| V-282 RFG mix drum | N/A | RFG | N/A | BTU analyzer of the refinery gas mix drum | N/A | N/A | annual | EAI9204A heating value analyzer of RFG- backup to lab samples. |
| V-282 RFG mix drum | N/a | RFG | N/A | Specific gravity analyzer of the refinery gas mix drum. | N/A | N/A | annual | EAI9204C specific gravity analyzer of the RFG- backup to lab samples. |

Note: Orifice plates inspected on 3 year cycle (post 2010). <annual = means more calibrated more frequently than every year. Polymers was part of the Marcus Hook Refinery in the first quarter of 2010 and then sold to Brasschem Corporation For the first quarter of 2010 Polymers $CO_2$ emissions to be included in the Marcus Hook $CO_2$ inventory

**Appendix C – Subpart Y Petroleum Refineries**

| Source ID | Fuel | Fuel Measurement | Fuel Analysis | Emissions Equation | Calibration Frequency | Equation Inputs |
|---|---|---|---|---|---|---|
| 12-3 flare (normal operation) | From Stack test | Use stack test flow | From stack test | Y-3,4 & 5 | N/A | N/A – no instrument inputs |
| 12-3 flare (SSM Events) | Determined by Tech Service | None – judgment & process knowledge | N/A | Y-3,4 & 5 | N/A | N/A – no instrument inputs |
| 10-4 flare | From Stack test | Use stack test flow | From stack test | Y-3,4 & 5 | N/A | N/A – no instrument inputs |
| 10-4 flare (SSM events) | Determined by Tech Service | None - judgment & process knowledge | N/A | Y-3,4 &5 | N/A | N/A – no instrument inputs |
| EC Flare (normal operation) | Process gases | Flow Meter | Lab Sampling (weekly) | Y-1,4 & 5 | annual | TFI4601C flare mass flow |
| EC Flare (SSM Events) | Upsets | Flow Meter | N/A | Y-1, 4 & 5 | annual | TFI4601C flare mass flow |
| FCCU Coke | Coke Burn | Flow Meters, Gas analyzers | N/A | Y-6 & 7 | annual | BFC1003 Regen Air flow |
| | | | Orifice plate | Y-9 & 10 | annual | BFI1004 Snort Air (to Atmosphere) |
| | | | | | annual | BTI1005 Air Temp Correction |
| | | | | | annual | BPI1007 Air Pressure Correction |
| | | | | | <annual | BAI2295A Regen CO2 analyzer |
| | | | | | <annual | BAI2295B Regen CO analyzer |
| | | | | | <annual | BAI2295C Regen O2 analyzer |

| | | | | | | |
|---|---|---|---|---|---|---|
| Acid Gas to SRU#1 | Acid gas (h2s) | Acid gas meter | Use default value =.2 | Y-12 | annual<br>annual<br>annual | CFC8400C Acid Gas to SRU #1<br>CTI5839 Temp Correction<br>CPI8602 Pressure Correction |
| Sour Water Gas to SRU #1 | Sour Water Gas | Sour Water Gas Meter | Use default value =.2 | Y-12 | annual<br>annual<br>annual | CFC8403C SW Gas to SRU #1<br>CTI5833 Temp Correction<br>CPI 8602 Pressure Correction |
| Acid Gas to SRU #2 | Acid Gas (h2s) | Acid Gas Meter | Use default value =.2 | Y-12 | annual<br>annual<br>annual | DFC8400C Acid Gas to SRU #2<br>DTI5839 Temp Correction<br>DPI8602 Pressure Correction |
| Sour Water Gas to SRU #2 | Sour Water Gas | Sour Water Meter | Use default value =.2 | Y-12 | annual<br>annual<br>annual | DFC8403C SW Gas to SRU #2<br>DTI5833 Temp Correction<br>DPI8602 Pressure Correction |
| Loading/ Operations | Crude & products with vapor phase methane >.5% | Loading Records | Loading Records | N/A | N/A | Loading Operations Gases are collected in the dock Vapor Recovery system which then compresses gas and sends to Refinery Fuel Gas System. Green house affect already included in Combustion sources. |
| Tank Emissions | Crude +intermediates Storage tanks | Tanks | N/A | Y-22 | N/A | Total Receipts from accounting |
| Reformer Regenerations | Gasoline Reformer Regens | Coke burn estimates from tech service. | N/A | Y-11 | N/A | Number of Regenerations of Reformer during the year. Coke burn off estimates from tech service. |
| Fugitive Emissions | LDAR programs | N/A | N/A | Y-21 | N/A | Used default equation |

Polymers was part of the Marcus Hook Refinery in the first quarter of 2010 and then sold to Brasschem Corporation For the first quarter of 2010 Polymers $CO_2$ emissions to be included in the Marcus Hook $CO_2$ inventory

**Appendix D – Subpart MM Petroleum Products**

Subpart MM constituents (Petroleum Products) are calculated by using the equations below:

$$CO_{2i} = Product_i \star EF_i \qquad \text{(Eq. MM-1)}$$

Where:

$CO_{2i}$= Annual $CO_2$ emissions that would result from the complete combustion or oxidation of each petroleum product or natural gas liquid "i" (metric tons).

$Product_i$= Annual volume of product "i" produced, imported, or exported by the reporting party (barrels). For refiners, this volume only includes products ex refinery gate. For natural gas liquids, volumes shall reflect the individual components of the product as listed in Table MM–1 of this subpart.

$EF_i$= Product-specific $CO_2$ emission factor (metric tons $CO_2$ per barrel).

Typical factors for the typical MM products are summarized below (from table MM-1 part 98). Remaining factors can be found in the Greenhouse Gas Rule.

| Source | Grade | Raw Material or Product | Measurement | Emissions Factor |
|---|---|---|---|---|
| Conventional Summer Gasoline | Regular | Product | Vortex Meter | 0.3753 |
| Conventional Summer Gasoline | Midgrade | Product | Vortex Meter | 0.3758 |
| Conventional Summer Gasoline | Premium | Product | Vortex Meter | 0.3763 |
| Distillate No. 2 | Ultra Low Sulfur | Product | Tank Gauges | 0.4296 |
| Distillate No. 2 | Low Sulfur | Product | Tank Gauges | 0.4296 |
| Distillate No. 2 | High Sulfur | Product | Tank Gauges | 0.4296 |

Volumes for refinery Shipped products are typically via custody transfer transactions. Volumes are tracked via Sunoco's accounting software. Shipment transactions are also subject to Foreign Trade Zone rules. Below are inputs to the accounting system for shipment and receipt information:

Methods of Delivery:

- Vessels - all crude for MH
- Pipelines - some receipts and most shipments
- Rail Car - receipts and shipments
- Tank Truck - receipts and shipments

These are Custody Transfer transactions and are reconciled to the financial systems transactions for the financial close each month.

Transaction Descriptions:

- Vessel volumes are confirmed by the Commercial Operating Associate in the R&S Waterborne Supply department based on Independent Inspectors gauges of either shore tanks or Vessel volumes.
- Pipeline volumes are provided primarily by 3rd party pipeline tickets. We do have some pipeline volumes calculated by internal company meters.
- Rail Car volumes are based on BOLs, Sunoco or 3rd Party, calculated using scale weights, meters or Rail Car strapping tables and outage gauges.
- Tank Truck volumes are based on BOLs, Sunoco or 3rd Party, calculated using scale weights or meters.

Quality Control on third party transfers

- Scale is calibrated at least semi-annually; and certified annually by Pennsylvania Bureau of Weights and Measures; is also certified by the Delaware County Office of Consumer Affairs Weights and Measures Division.
- Pipe Line Transfers are custody transfers that follow API recommended practices. Pipe line meters are calibrated as per those recommended practices.